MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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Maintenance Questionnaire and List of Respondents*
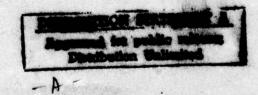
See 1473

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Abstract

This paper contains the maintenance questionnaire
and list of respondent organizations for a
maintenance survey conducted in 1976.

Nov. 1976
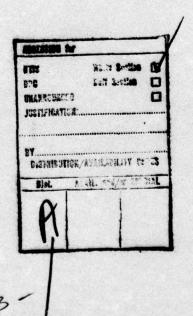
-A-

1. Introduction and Summary

There has been an increasing concern with the operational phase of the life cycle of software systems. This phase is concerned with the maintenance and enhancement of computer based information systems. Maintenance is the process of having the system meet the requirements specified in development. Enhancements are changes made to the system to meet new requirements.

To analyze these processes a questionnaire was constructed, field tested, and finalized. *(This report contains that)* A copy appears in section 2. The questionnaire, *which* is divided into two parts: one dealing with the systems data processing and programming department and the other with a specific application system being maintained and enhanced. The questionnaire includes items of both technical and managerial interest.

The questionnaire was distributed to 120 organizations. Responses were collected for 69 applications. *which* The organizations responding are *also listed* listed in section 3.

The analysis of results and existing literature will appear in separate papers.

- B -

2. Questionnaire on Application Software Maintenance

The actual questionnaire begins on the next page.

A QUESTIONNAIRE ON APPLICATION SOFTWARE MAINTENANCE

INTRODUCTION

The purpose of the questionnaire is to assess some characteristics of application software maintenance, as it is performed by Systems & Programming departments of various types and sizes. The term maintenance includes _enhancements_.

The questionnaire consists of two parts. The first contains questions on the Systems & Programming department. The second, questions on a particular application system maintained by the department.

The questionnaire should be completed by the manager of the Systems & Programming department, with the assistance of his or her staff.

Some of the questions call for facts which may not be readily determined within the Systems & Programming department. These questions are followed by a set of three queries requesting the basis of the answer given, vis-a-vis:

```
---------------------------------------------------
| Check the applicable statement:                 |
|                                                 |
| The above answer is:                            |
| Reasonably accurate, based on good data___      |
| A rough estimate, based on minimal data___      |
| An estimate, not based on any data___           |
---------------------------------------------------
```

Space for "remarks" is also frequently included. Where you feel that your answer can be usefully clarified, please enter your remarks accordingly. It is imperative that every question be answered.

Your assistance and cooperation is greatly appreciated.

A QUESTIONNAIRE

CN

APPLICATICN SOFTWARE MAINTENANCE

PART I

Questions on the Systems & Programming Department

July 1976

1. To what industry does the organization served by your department belong? (Check the one which most closely applies.)

Manufacturing industries:

   a. Data Processing Equipment |___|

   b. Instruments/Electrical |___|

   c. Chemical/Allied Products |___|

   d. Printing/Publishing |___|

   e. Food/Tobacco |___|

   f. Primary/Fabricated Metal |___|

   g. Transportation Equipment |___|

   h. Petroleum/Coal/Rubber |___|

   i. Paper/Paper Products |___|

   j. Textiles/Apparel |___|

   k. Other (Please indicate) _____

Non-manufacturing industries:

   a. Insurance |___|

   b. Banking/Credit Agency |___|

   c. EDP Services |___|

   d. Education |___|

   e. Government |___|

   f. Public Utility |___|

   g. Investment |___|

   h. Mining/Construction |___|

   i. Transportation |___|

   j. Consultants |___|

   k. Other (Please indicate) _____

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2. What is the annual budget of your company for data processing equipment rental, maintenance, and amortization expense? (Check the category which applies.)

        a. $2,000,000 or more |___|

        b. Less than $2,000,000, but $1,500,000 or more |___|

        c. Less than $1,500,000, but $1,000,000 or more |___|

        d. Less than $1,000,000, but $500,000 or more |___|

        e. Less than $500,000, but $250,000 or more |___|

        f. Less than $250,000, but $125,000 or more |___|

        g. Less than $125,000 |___|

3. What is the total number of personnel in your Systems & Programming department?

        -----

4. Of the total number of personnel, how many are employed as systems analysts and/or programmers?

Remarks:

5. Of the total number of systems analysts and programmers, how many work in each of the following categories:

	Programming but not systems analysis	Systems analysis, but not programming	Both programming and systems analysis
New application system development, but not application system maintenance			
Application system maintenance but not new application system development			
Both new application system development and application system maintenance			
Neither new application system development nor application system maintenance (e. g. systems programming)			

Remarks:

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6. Within your department, are formal lines of authority and responsibility drawn so as to separate the management of programming from the management of other activities?

                                        Yes: |___| No: |___|

Remarks:

7. Within your Systems & Programming department, are formal lines of authority and responsibility drawn so as to separate the management of application system maintenance from the management of other activities?

                                        Yes: |___| No: |___|

Remarks:

8. In terms of the total person-hours worked annually by your programming and systems analysis personnel, what percentage is spent in each of the following activities:

                        Application system maintenance: ____%
                        New application system development: ____%
                                                Other: ____%

                                                TOTAL: 100%

Remarks:

9. In your judgment, how important are the problems which arise in application system maintenance when compared to those of new application system development? (Check one of the following.)

    a. Maintenance problems by far the more important |___|

    b. Maintenance problems somewhat more important |___|

    c. Maintenance and new system development problems
        of equal importance |___|

    d. New system development problems somewhat more
        important |___|

    e. New system development problems by far the more
        important |___|

Remarks:

8

10. Suppose that the programming and systems analysis capacity of your department could be increased by 10% (in terms of the number of equivalent persons available). Assuming that needed skills are reflected in the increase, how would you allocate this additional capacity?

Application system maintenance:	____%
New application system development:	____%
Other Activities:	____%
TOTAL:	10%

Suppose instead that the capacity could be increased by 25%. How would you allocate this larger percentage increase?

Application system maintenance:	____%
New application system development:	____%
Other Activities:	____%
TOTAL:	25%

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11. Suppose that the programming and systems analysis capacity of your department was to be decreased by 10% (in terms of the number of equivalent persons available). Assuming that you could determine where the cut-back was to be made, how would you allocate the reduction?

Application system maintenance: ____%

New application system development: ____%

Other Activities: ____%

TOTAL: 10%

Suppose instead that the capacity was to be decreased by 25%. How would you allocate this larger percentage reduction?

Application system maintenance: ____%

New application system development: ____%

Other Activities: ____%

TOTAL: 25%

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12. Relative to the tasks at hand, how would you evaluate your current level of programming and systems analysis staffing, on the whole? (Check one of the following.)

        a. Substantially understaffed: |___|

        b. Somewhat understaffed: |___|

        c. Neither understaffed nor overstaffed: |___|

        d. Somewhat overstaffed: |___|

        e. Substantially overstaffed: |___|

Remarks:

A QUESTIONNAIRE

ON

APPLICATION SOFTWARE MAINTENANCE

PART II

The following questions are addressed to the maintenance of
a particular application system by your department

July 1976

1. Please identify an application system maintained by your department which: (i) has been operational one year or longer; (ii) represents a significant investment of time and effort by your department; and (iii) is considered by management to be of fundamental importance to the organization.

    Name of application system: _____
    Basic function (Describe briefly):

2. What organizational units are the primary users of the application system? (A "primary user" is defined here as a unit which receives outputs from, or provides inputs to the application system.)

3. What is the total number of personnel in the primary user units, taken together?

_____

```
┌─────────────────────────────────────────────────┐
│ Check the applicable statement:                 │
│                                                 │
│ The above answer is:                            │
│ Reasonably accurate, based on good data___      │
│ A rough estimate, based on minimal data___      │
│ An estimate, not based on any data___           │
└─────────────────────────────────────────────────┘
```

4. Of the total number of personnel in the primary user units, what percentage is actively engaged in receiving the outputs or providing the inputs?

____%

```
┌─────────────────────────────────────────────────┐
│ Check the applicable statement:                 │
│                                                 │
│ The above answer is:                            │
│ Reasonably accurate, based on good data___      │
│ A rough estimate, based on minimal data___      │
│ An estimate, not based on any data___           │
└─────────────────────────────────────────────────┘
```

5. On what date (month and year) did the application system become operational?

Year _____

Month _____

Remarks:

14

6. What is the total number of programs in the application system maintained? (The term "program" is associated here with a block of source language statements compiled or assembled as a unit.)

```
+---------------------------------------------------+
| Check the applicable statement:                   |
|                                                   |
| The above answer is:                              |
| Reasonably accurate, based on good data___        |
| A rough estimate, based on minimal data___        |
| An estimate, not based on any data___             |
+---------------------------------------------------+
```

7. What is the total number of source language statements (excluding comments) included in the application system maintained?

```
+---------------------------------------------------+
| Check the applicable statement:                   |
|                                                   |
| The above answer is:                              |
| Reasonably accurate, based on good data___        |
| A rough estimate, based on minimal data___        |
| An estimate, not based on any data___             |
+---------------------------------------------------+
```

8. Of the total number of source language statements maintained, what percentage is written in each of the following languages?

COBOL	____%
FORTRAN	____%
Assembler	____%
PL/1	____%
RPG	____%

Others (Please indicate):

_____	____%
_____	____%
_____	____%

TOTAL   100%

```
Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___
```

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9. Of the total number of source language statements maintained, what percentage originated in each of the following time periods?

1975 - 76	____%
1973 - 74	____%
1971 - 72	____%
1969 - 70	____%
1967 - 68	____%
1966 or earlier	____%
TOTAL	100%

```
Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___
```

10. Of the total number of source language statements maintained, what percentage is associated with programs which carry out online processing?

____%

```
Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___
```

11. What is the total number of machine language instructions (object lines of code) of the application system maintained?

```
Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___
```

12. How many computer systems - hardware - are employed in the operational processing of the application system maintained?

If more than one, please specify their operational processing function in terms of the application system maintained:

13. Please identify the following characteristics of each computer system - hardware and software - employed in the operational processing of the application system:

Manufacturer(s) _____

Model(s) _____

Month/year when model(s) became operational _____ _____

Operating System Software _____

14. Is distributed processing employed in the processing of the application system? (The term "distributed processing" implies segmenting data bases and distributing application software processing among computers at different locations.)

Yes: |___| No: |___|

15. Is a data base management system employed in the processing of the application system?

Yes: |___| No: |___|

If so, which? _____

16. How many individual data files make up the data base associated with the application system? (The term "data base" is defined here simply as the set of master files associated with a system.)

_ _ _ _ _

Remarks:

17. What is the average size of the data base, measured in total number of bytes (or the equivalent)?

_ _ _ _ _

```
Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___
```

18. Of the total number of bytes contained in the data base, what percentage is the result of an update made during each of the following time periods, on the average?

The most recent day: ____%

Not the most recent day,
but the most recent week: ____%

Not the most recent week,
but the most recent month: ____%

Not the most recent month,
but the most recent quarter: ____%

Not the most recent quarter,
but the most recent year: ____%

Not the most recent year: ____%

TOTAL 100%

```
--------------------------------------------------
| Check the applicable statement:                |
|                                                |
| The above answer is:                           |
| Reasonably accurate, based on good data___     |
| A rough estimate, based on minimal data__      |
| An estimate, not based on any data___          |
--------------------------------------------------
```

19. How many pre-defined user reports are associated with the application system maintained?

_____

```
.--------------------------------------------.
| Check the applicable statement:            |
|                                            |
| The above answer is:                       |
| Reasonably accurate, based on good data___ |
| A rough estimate, based on minimal data___ |
| An estimate, not based on any data___      |
'--------------------------------------------'
```

Remarks:

20. Of the pre-defined user reports, how many are issued in each of the following forms:

Visual display or printed, on demand ___

Visual display or printed, daily ___

Visual display or printed, weekly ___

Visual display or printed, monthly ___

Visual display or printed, quarterly ___

Visual display or printed, semi-annually ___

Visual display or printed, annually ___

Others (Please indicate):

-------------------------------------- ___

-------------------------------------- ___

-------------------------------------- ___

```
-------------------------------------------------
| Check the applicable statement:                |
|                                                |
| The above answer is:                           |
| Reasonably accurate, based on good data___     |
| A rough estimate, based on minimal data___     |
| An estimate, not based on any data___          |
-------------------------------------------------
```

Remarks:

21. Which of the following tools and techniques were employed in the development of the application system? (Check those which apply.)

      a. Decision tables |___|

      b. Data base dictionary |___|

      c. Test data generators |___|

      d. Structured programming |___|

      e. ISDOS (Information System Design and Optimization System) |___|

      f. Chief Programmer Team |___|

      g. On-line Programming |___|

      h. Automated flowcharting |___|

      i. HIPO (Hierarchy plus Process-Output) Design Aid Technique |___|

      j. Structured Walk-thru |___|

      Others (Please indicate):

      k. _____ |___|

      l. _____ |___|

      m. _____ |___|

22. What is the total number of person-hours now expended annually on maintenance of the application system?

```
+----------------------------------------------+
| Check the applicable statement:              |
|                                              |
| The above answer is:                         |
| Reasonably accurate, based on good data___   |
| A rough estimate, based on minimal data___   |
| An estimate, not based on any data___        |
+----------------------------------------------+
```

23. Of the total number of person-hours now expended annually cn maintenance of the application system, what percentage is expended in each of the following problem areas:

a. Emergency program fixes   ____%

b. Routine debugging   ____%

c. Accommodation of changes to data inputs and files   ____%

d. Accommodation of changes to hardware and system software   ____%

e. Enhancements for users   ____%

f. Improvement of program documentation   ____%

g. Recoding for efficiency in computation   ____%

Others (Please indicate):

h. _____ ____%

i. _____ ____%

j. _____ ____%

          TOTAL   100%

```
Check the applicable statement:

The above answer is:
Reasonably accurate, based on good data___
A rough estimate, based on minimal data___
An estimate, not based on any data___
```

24. Of the total number of person-hours now expended annually on maintenance of the application system, what percentage is spent on maintenance of programs which perform online processing?

_____%

```
┌─────────────────────────────────────────────┐
│ Check the applicable statement:             │
│                                             │
│ The above answer is:                        │
│ Reasonably accurate, based on good data___  │
│ A rough estimate, based on minimal data___  │
│ An estimate, not based on any data___       │
└─────────────────────────────────────────────┘
```

25. Of the total number of person-hours now expended annually on maintenance of the application system, what percentage is spent in communication with the user?

_____%

```
┌─────────────────────────────────────────────┐
│ Check the applicable statement:             │
│                                             │
│ The above answer is:                        │
│ Reasonably accurate, based on good data___  │
│ A rough estimate, based on minimal data___  │
│ An estimate, not based on any data___       │
└─────────────────────────────────────────────┘
```

26. What is the total number of individuals currently assigned (in whole or in part) to maintenance of the application system?

_____

27. Of the total number of individuals currently assigned to the maintenance of the application system, how many began their assignment in each of the following time periods?

1975 - 76	_____
1973 - 74	_____
1971 - 72	_____
1969 - 70	_____
1967 - 68	_____
1966 or earlier	_____

Remarks:

28. Of the total number of individuals currently assigned to the maintenance of the application system, how many are assigned to each of the following tasks?

a. Programming exclusively: _____

b. Systems analysis exclusively: _____

c. Both programming and systems analysis: _____

d. Neither programming nor systems analysis (e.g. librarian): _____

Remarks:

29. Of the total number of individuals currently assigned to the maintenance of the application system, how many have each of the following levels of on-the-job programming experience?

       a. Five years or more: _____

       b. Less than five years, but three or more: _____

       c. Less than three years, but one or more: _____

       d. Less than one year, but some: _____

       e. None of the above: _____

Remarks:

30. Are all changes made to the application system programs logged and documented according to an established organizational procedure?

                      Yes: |___| No: |___|

How many changes were recorded during the past twelve months?

                                      _____

31. Are all user requests for changes to the application system logged and documented according to an established organizational procedure?

Yes: |___| No: |___|

How many requests were recorded during the past twelve months?

Of the requests recorded during the past twelve months, how many have now been satisfied by changes made to the application system?

Remarks:

32. Are all troubles encountered in the operational processing of the application system programs logged and documented according to an established organizational procedure?

Yes: |___| No: |___|

How many trouble reports were recorded during the past twelve months?

-----

33. Is a formal audit of the application system made periodically, according to an established organizational procedure?

Yes: |___| No: |___|

If so, how frequently, on the average?

_____

34. Is the documentation associated with the application system programs maintained by a program or system librarian?

Yes: |___| No: |___|

Remarks:

35. Is an accounting procedure employed to accumulate the personnel costs in your department associated with operating and maintaining the application system?

Yes: |___| No: |___|

If so, what was the total personnel cost (in dollars) accumulated during the last twelve months?

Remarks:

36. Is an accounting procedure employed to accumulate the equipment costs in your department associated with operating and maintaining the application system?

Yes: |___| No: |___|

If so, what was the total equipment cost (in dollars) accumulated during the past twelve months?

Remarks:

37. Are the personnel and equipment costs associated with operating and maintaining the application system charged back (in whole or in part) to the user?

Yes: |___| No: |___|

If so, on what basis is the charge made? (Check one.)

a. Equipment utilization exclusively: |___|

b. Personnel utilization exclusively: |___|

c. Both equipment and personnel utilization: |___|

d. Neither equipment nor personnel utilization: |___|

If costs are charged back to the user, what was the amount charged during the past twelve months?

Remarks:

38. In your judgment, to what extent have the following been (or are) problems in maintaining the application system you have described?

		Major Problem	Somewhat Major	Minor Problem	Somewhat Minor	None At All
		5	4	3	2	1
a.	Turnover of maintenance personnel					
b.	Quality of application system documentation					
c.	Changes made to system hardware and software					
d.	User demand for enhancements and extensions to application system					
e.	Skills of maintenance programming personnel					
f.	Quality of original programming of application system					
g.	Number of maintenance programming personnel available					
h.	Competing demands for maintenance programming personnel time					
i.	Lack of user interest in application system					
j.	Application system run failures					
k.	Lack of user understanding of application system					

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	Major Problem	Somewhat Major	Minor Problem	Somewhat Minor	None At All
	5	4	3	2	1
l. Storage requirements of application system programs					
m. Processing time requirements of application system programs					
n. Motivation of maintenance programming personnel					
o. Forecasting of maintenance programming personnel requirements					
p. Maintenance programming productivity					
q. System hardware & software reliability					
r. Data integrity in application system					
s. Unrealistic user expectations					
t. Adherence to programming standards in maintenance					
u. Management support of application system					
v. Adequacy of application system design specifications					
w. Budgetary pressures					
X. Meeting scheduled commitments					

```
                                    _____
                                   | None    At   All |           |
                                 _____|        |
                                | Somewhat Minor |      |         |
                              _____|  |        |
                             | Minor  Problem |     |   |         |
                           _____|    |        |
                          | Somewhat Major |    |    |    |        |
                        _____|    |   |       |
                       | Major  Problem |   |    |    |    |       |
                     _____|    |   |   |      |
                    | 5 | 4 | 3 | 2 | 1 |
                    |___|___|___|___|___|
```

Others (Please indicate):

y. _____ |___|___|___|___|___|

z. _____ |___|___|___|___|___|

3. Responding Organizations

   Below is a list of the organizations that responded to the questionnaire.

1. American Automobile Association
2. Architects Limited
3. Atlantic Richfield Company
4. Avco Financial Services
5. Bankamericard Systems
6. Bank of America
7. Baskins and Robbins
8. Bell Industries
9. B.F. Goodrich Company
10. Brazilian Systems, Inc.
11. Burroughs--Management Services
12. Burroughs Corporation--Western Application Development Center
13. Byron Jackson Pump Division
14. City of Los Angeles
15. Coast Community College District
16. Firestone Tire and Rubber Company
17. Ford Motor Company
18. Franklin Computer Services
19. General Motors Corporation
20. Getty Oil Corporation
21. Gibraltar Savings and Loan Association
22. Glendale Federal Savings and Loan Association

23. Great Western Savings

24. Hawaiian Telephone

25. H.C. and D., Limited

26. Honeywell Information Systems

27. Hughes Aircraft

28. Hughes Airwest

29. Hughes Markets, Incorporated

30. Island Insurance

31. Knape and Vogt Manufacturing Company

32. Knudsen Corporation

33. Lever Brothers

34. Litton Industries

35. Lloyd's Bank of California

36. Los Angeles City Schools

37. Los Angeles County

38. Los Angeles Department of Water and Power

39. Los Angeles Times

40. Market Basket

41. May Company

42. NCR

43. Northrop Corporation

44. Occidental Life Insurance

45. Pennsylvania Life Insurance

46. Pertec

47. Petrobas

48. Price Waterhouse and Company

49. Revell Incorporated

50. San Fernando Board of Realtors

51. Security Pacific National Bank

52. Sistema and Computacao

53. Southern California Edison

54. Southern California Gas Company

55. State of California Department of Motor Vehicles

56. Sunkist Growers

57. Thrifty Stores

58. Tobias Kotzin

59. Transamerica

60. UCLA Administrative Center

61. UCLA Medical School

62. Union Oil Company

63. University of California

64. United California Bank

65. Van de Kamps

66. Veterans Administration

67. Walt Disney Productions

68. Western Airlines

69. Xerox Computer Services

4. Acknowledgement

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Report	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Maintenance Questionnaire and List of Respondents.		5. TYPE OF REPORT & PERIOD COVERED Technical rept.
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) B. P. Lientz, E. B. Swanson and G. E. Tompkins		8. CONTRACT OR GRANT NUMBER(s) N00014-75-C-0266
9. PERFORMING ORGANIZATION NAME AND ADDRESS Graduate School of Management University of California, Los Angeles		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS NR 049-345
11. CONTROLLING OFFICE NAME AND ADDRESS Information Systems Program Office of Naval Research, Arlington, Va.		12. REPORT DATE 11/76 Nov 76
		13. NUMBER OF PAGES 41
14. MONITORING AGENCY NAME & ADDRESS(If different from Controlling Office) 43 P.		15. SECURITY CLASS. (of this report) unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

distribution of this document is unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

maintenance, survey, enhancements

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This paper contains the maintenance questionnaire and list of respondent organizations for a maintenance survey conducted in 1976.

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1 JAN 73
S/N 0102-014-6601 |

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